

**International Preliminary  
Examination Report (IPER)  
Amendments**

10/593903

AMENDMENT

To : Examinaer of the Patent Office

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1. Identification of the International Application  
PCT/JP2004/003895

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4. Item to be Amended

Description and Claims

5 5. Contents of Amendment

(1) Delete Line 24 of Page 5 to Line 10 of Page 14 of the description.

Moreover, add the following to Line 24 of Page 5 to Page 13/2 of the description.

10 In a third aspect of the invention,

there is provided a tube by electroforming producing method comprising the steps of: forming an electrodeposit material or a surrounding material around a thin wire material by electroforming ; and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein the thin wire material is removed by pulling the material from one end or both ends, deforming the material so as to reduce a sectional area thereof, and forming a clearance between the thin wire material and the electrodeposit material or the surrounding material, followed by gripping and pulling the thin wire material, sucking the material, physically pushing away the material, or blowing a gas or a liquid to push away the material.

25 In a fourth aspect of the invention,

there is provided the tube electroforming method according to the third aspect of the invention,

wherein an amount of an end-portion-side

electrodeposit material or surrounding material to be formed on the thin wire material is increased.

In a fifth aspect of the invention,

there is provided the tube electroforming method according to the third aspect of the invention,

wherein a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of the sectional area.

In a seventh aspect of the invention,

there is provided the tube electroforming method according to the third, fourth or fifth aspect of the invention,

wherein the thin wire material including a conductive layer disposed on an outer surface thereof is used, and the thin wire material is removed so that the conductive layer remains on an inner surface of a tube by electroforming.

In an eighth aspect of the invention,

there is provided the tube electroforming method according to the third, fourth or fifth aspect of the invention,

wherein the thin wire material is used in which at least two conductive layers constituted of different materials are formed on an outer surface of the material, the electrodeposit material or the surrounding material is brought into close contact with the outer conductive layer of the thin wire material, and the thin wire material is

removed so that the inner conductive layer remains on an inner surface of the tube by electroforming .

In a ninth aspect of the invention,

there is provided the tube electroforming method according to the third, fourth, fifth, seventh or eighth aspect of the invention,

wherein an inner shape of a hollow portion formed by removing the thin wire material from the electrodeposit material or the surrounding material has a circular sectional shape or a polygonal sectional shape.

In a tenth aspect of the invention,

there is provided the tube electroforming method according to the third, fourth, fifth, seventh, eighth or ninth aspect of the invention,

wherein the tube by electroforming includes a plurality of hollow portions formed by removing the thin wire material.

In an eleventh aspect of the invention,

there is provided the tube electroforming method according to the tenth aspect of the invention,

wherein a partition wall member formed by disposing a conductive layer on an outer surface of an insulator is disposed between the hollow portions, whereby each portion forming a periphery of each hollow portion independently conducts electricity.

In a twelfth aspect of the invention,

there is provided a tube by electroforming

produced by forming an electrodeposit material or a surrounding material around a thin wire material by electroforming , and removing the thin wire material from the electrodeposit material or the surrounding material,

5            wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape,  
10           a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape,

             there are a plurality of hollow portions formed by removing the thin wire material, and

15           a partition wall member formed by disposing a conductive layer on an outer surface of an insulator is disposed between the hollow portions, whereby each portion forming a periphery of each hollow portion independently conducts electricity.

20           In a thirteenth aspect of the invention,  
             there is provided the tube by electroforming according to the twelfth aspect of the invention,  
             having a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

25           In a fourteenth aspect of the invention,  
             there is provided the tube by electroforming according to the twelfth or thirteenth aspect of the

invention,

having an inner surface provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material.

5 In a fifteenth aspect of the invention,

there is provided the tube by electroforming according to the twelfth or thirteenth aspect of the invention,

10 having an inner surface of the tube is provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material, a further conductive layer constituted of a material different from that of the conductive layer being disposed between the electrodeposit material or the  
15 surrounding material and the conductive layer.

In an eighteenth aspect of the invention,

there is provided the tube by electroforming according to the twelfth, thirteenth, fourteenth or fifteenth aspect of the invention,

20 wherein the conductive layer disposed on the outer surface of the partition wall member is constituted to form a part of the hollow portion.

In a nineteenth aspect of the invention,

25 there is provided the tube by electroforming according to the twelfth, thirteenth, fourteenth, fifteenth or eighteenth aspect of the invention,

wherein a portion of the partition wall member

disposed between the hollow portions disposed adjacent to each other has a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

In a twentieth aspect of the invention,

5           there is provided a thin wire material for production of a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming , and removing the thin wire material from the electrodeposit material or the  
10           surrounding material,

          wherein an outer diameter of the thin wire material is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an outer shape of the thin wire material has a circular sectional shape, a diameter of an inscribed circle is 10  $\mu\text{m}$  or more  
15           and 85  $\mu\text{m}$  or less, when the outer shape of the thin wire material has a polygonal sectional shape, and a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of a sectional area.

20           In a twenty-fifth aspect of the invention,

          there is provided a thin wire material for production of a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming , pulling the thin  
25           wire material from one end or both ends to deform the material so that a sectional area thereof is reduced, forming a clearance between the thin wire material and the



electrodeposit material or the surrounding material to  
extract the thin wire material, and removing the thin wire  
material from the electrodeposit material or the  
surrounding material to produce a tube by electroforming,

5            wherein an outer diameter of the thin wire  
material is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an outer  
shape of the thin wire material has a circular sectional  
shape, a diameter of an inscribed circle is 10  $\mu\text{m}$  or more  
and 85  $\mu\text{m}$  or less, when the outer shape of the thin wire  
10 material has a polygonal sectional shape, and a deformation  
amount of a lateral distortion at a time when the thin wire  
material is pulled and extended outwards is 5% or more of  
the sectional area.

          In a twenty-sixth aspect of the invention,  
15            there is provided the thin wire material for the  
production of the tube by electroforming according to the  
twentieth or twenty-fifth aspect of the invention,

          having an outer surface provided with a conductive  
layer constituted of a material different from that of the  
20 electrodeposit material or the surrounding material.

          In a twenty-seventh aspect of the invention,  
          there is provided the thin wire material for the  
production of the tube by electroforming according to the  
twentieth or twenty-fifth aspect of the invention,

25            having an outer surface provided with a conductive  
layer constituted of a material different from that of the  
electrodeposit material or the surrounding material, and a

further conductive layer constituted of a material different from that of the conductive layer being disposed between a base member of the thin wire material and the conductive layer.

5           In a twenty-eighth aspect of the invention,  
          there is provided the thin wire material for the production of the tube by electroforming according to the twentieth, twenty-fifth, twenty-sixth or twenty-seventh aspect of the invention,

10           wherein there are opposite end portions on which any conductive layer is not disposed.

          In a twenty-ninth aspect of the invention,  
          there is provided the thin wire material for the production of the tube by electroforming according to the  
15   twentieth, twenty-fifth, twenty-sixth, twenty-seventh or twenty-eighth aspect of the invention,

          having an outer shape formed into a circular sectional shape or a polygonal sectional shape.

          In a thirtieth aspect of the invention,  
20           there is provided a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming , and removing the thin wire material from the electrodeposit material or the surrounding material,

25           wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow

portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape.

In a thirty-first aspect of the invention, there is provided a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, pulling the thin wire material from one end or both ends to deform the material so that a sectional area thereof is reduced, forming a clearance between the thin wire material and the electrodeposit material or the surrounding material to extract the thin wire material, and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape.

In a thirty-second aspect of the invention, there is provided the tube by electroforming according to the thirtieth or thirty-first aspect of the

invention, having a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

In a thirty-third aspect of the invention,  
there is provided the tube by electroforming  
5 according to the thirtieth, thirty-first or thirty-second  
aspect of the invention,

having an inner surface provided with a conductive  
layer constituted of a material different from that of the  
electrodeposit material or the surrounding material.

10 In a thirty-fourth aspect of the invention,  
there is provided the tube by electroforming  
according to the thirtieth, thirty-first or thirty-second  
aspect of the invention,

having an inner surface of the tube provided with  
15 a conductive layer constituted of a material different from  
that of the electrodeposit material or the surrounding  
material, a further conductive layer constituted of a  
material different from that of the conductive layer being  
disposed between the electrodeposit material or the  
20 surrounding material and the conductive layer.

In a thirty-fifth aspect of the invention,  
there is provided the tube by electroforming  
according to the thirty-first, thirty-second, thirty-third  
or thirty-fourth aspect of the invention,

25 wherein there are a plurality of hollow portions  
formed by removing the thin wire material.

(2) In Page 54 to 62 of the claims, delete Claims 1, 2, 6, 16, 17, 21, 22, 23 and 24, and add Claims 25 to 35.

Moreover, in Claim 3, amend "A tube by  
5 electroforming producing method ..., characterized in that"  
to "A tube electroforming method ..., wherein".

In Claim 4, amend "according to claim 1, 2 or 3,  
characterized in that" to "according to claim 3, wherein".

In Claim 5, amend "according to claim 3,  
10 characterized in that" to "according to claim 3, wherein".

In Claim 7, amend "according to claim 1, 2, 3, 4,  
5 or 6, characterized in that" to "according to claim 3, 4  
or 5, wherein".

In Claim 8, amend "according to claim 1, 2, 3, 4,  
15 5 or 6, characterized in that" to "according to claim 3, 4  
or 5, wherein".

In Claim 9, amend "according to claim 1, 2, 3, 4,  
5, 6, 7 or 8, characterized in that" to "according to claim  
3, 4, 5, 7 or 8", wherein.

20 In Claim 10, amend "according to claim 1, 2, 3, 4,  
5, 6, 7, 8 or 9, characterized in that" to "according to  
claim 3, 4, 5, 7, 8 or 9, wherein".

In Claim 11, amend "according to claim 10,  
characterized in that" to "according to claim 10, wherein".

25 Moreover, in Claim 12, amend "characterized in  
that a hollow portion is formed by removing the thin wire  
material from the electrodeposit material or the

surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape." to

"wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape, there are a plurality of hollow portions formed by removing the thin wire material, and a partition wall member formed by disposing a conductive layer on an outer surface of an insulating material is disposed between the hollow portions, whereby each portion forming a periphery of each hollow portion independently conducts electricity."

In Claim 13, amend "according to claim 12, characterized in that" to "according to claim 12,".

In Claim 14, amend "according to claim 12 or 13, characterized in that" to "according to claim 12 or 13,".

In Claim 15, amend "according to claim 12 or 13, characterized in that" to "according to claim 12 or 13,".

In Claim 18, amend "according to claim 17,

characterized in that" to "according to claim 12, 13, 14 or 15, wherein".

In Claim 19, amend "according to claim 17 or 18, characterized in that" to "according to claim 12, 13, 14, 15 or 18, wherein".

In Claim 20, amend "A thin wire material for production of a tube by electroforming ..., characterized in" to "A thin wire material for production of a tube by electroforming ..., wherein".

6. List of Attached Documents

(1) Pages 5, 6, 7, 8, 9, 10, 11, 12, 13, 13/1, 13/2, and 14 of the specification

(2) Pages 54, 55, 56, 57, 58, 59, 60, 61, 62 and 62/1 of the claims

conductive layer and an electrodeposit material or a surrounding material, a tube by electroforming, and a thin wire material for production of the tube by electroforming;

(5) to provide a method of producing a tube by electroforming including a plurality of hollow portions, and a tube by electroforming;

(6) to provide a method of producing a tube by electroforming including a plurality of hollow portions so that each portion forming a periphery of each hollow portion can independently conduct electricity, and a tube by electroforming; and

(7) to provide a tube electroforming method in which a tensile force is not easily applied to a conductive layer disposed on an inner surface of a tube by electroforming in a case where a thin wire material is removed, whereby the conductive layer is easily separated from a base wire material, and a close contact property between the conductive layer and an electrodeposit material or a surrounding material is not easily impaired.

#### Disclosure of the Invention

Means of the present invention developed in order to achieve the above objects are as follows.

In a third aspect of the invention,

there is provided a tube electroforming method comprising the steps of: forming an electrodeposit material or a surrounding material around a thin wire material by



electroforming; and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein the thin wire material is removed by pulling the material from one end or both ends, deforming the material so as to reduce a sectional area thereof, and  
5 forming a clearance between the thin wire material and the electrodeposit material or the surrounding material, followed by gripping and pulling the thin wire material, sucking the material, physically pushing away the material,  
10 or blowing a gas or a liquid to push away the material.

In a fourth aspect of the invention,

there is provided the tube electroforming method according to the third aspect of the invention,

wherein an amount of an end-portion-side electrodeposit or surrounding material to be formed on the  
15 thin wire material is increased.

In a fifth aspect of the invention,

there is provided the tube electroforming method according to the third aspect of the invention,

20 wherein a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of the sectional area.

In a seventh aspect of the invention,

there is provided the tube electroforming method  
25 according to the third, fourth or fifth aspect of the invention,

wherein the thin wire material including a

conductive layer disposed on an outer surface thereof is used, and the thin wire material is removed so that the conductive layer remains on an inner surface of a tube by electroforming.

5           In an eighth aspect of the invention,  
          there is provided the tube electroforming method according to the third, fourth or fifth aspect of the invention,

          wherein the thin wire material is used in which at  
10   least two conductive layers constituted of different materials are formed on an outer surface of the material, the electrodeposit material or the surrounding material is brought into close contact with the outer conductive layer of the thin wire material, and the thin wire material is  
15   removed so that the inner conductive layer remains on an inner surface of the tube by electroforming.

          In a ninth aspect of the invention,  
          there is provided the tube electroforming method according to the third, fourth, fifth, seventh or eighth  
20   aspect of the invention,

          wherein an inner shape of a hollow portion formed by removing the thin wire material from the electrodeposit material or the surrounding material has a circular sectional shape or a polygonal sectional shape.

25           In a tenth aspect of the invention,  
          there is provided the tube electroforming method according to the third, fourth, fifth, seventh, eighth or

ninth aspect of the invention,

wherein the tube by electroforming includes a plurality of hollow portions formed by removing the thin wire material.

5 In an eleventh aspect of the invention,  
there is provided the tube electroforming method according to the tenth aspect of the invention,

wherein a partition wall member formed by disposing a conductive layer on an outer surface of an  
10 insulating material is disposed between the hollow portions, whereby each portion forming a periphery of each hollow portion independently conducts electricity.

In a twelfth aspect of the invention,

there is provided a tube by electroforming  
15 produced by forming an electrodeposit material or a surrounding material around a thin wire material by electroforming, and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein a hollow portion is formed by removing the  
20 thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, a diameter of an inscribed circle of the hollow portion is  
25 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape,

there are a plurality of hollow portions formed by

removing the thin wire material, and

a partition wall member formed by disposing a  
conductive layer on an outer surface of an insulating  
material is disposed between the hollow portions, whereby  
5 each portion forming a periphery of each hollow portion  
independently conducts electricity.

In a thirteenth aspect of the invention,

there is provided the tube by electroforming  
according to the twelfth aspect of the invention,

10 having a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or  
less.

In a fourteenth aspect of the invention,

there is provided the tube by electroforming  
according to the twelfth or thirteenth aspect of the  
15 invention,

having an inner surface provided with a conductive  
layer constituted of a material different from that of the  
electrodeposit material or the surrounding material.

In a fifteenth aspect of the invention,

20 there is provided the tube by electroforming  
according to the twelfth or thirteenth aspect of the  
invention,

having an inner surface of the tube is provided  
with a conductive layer constituted of a material different  
25 from that of the electrodeposit material or the surrounding  
material, a further conductive layer constituted of a  
material different from that of the conductive layer being

disposed between the electrodeposit material or the surrounding material and the conductive layer.

In an eighteenth aspect of the invention,  
there is provided the tube by electroforming  
5 according to the twelfth, thirteenth, fourteenth or  
fifteenth aspect of the invention,

wherein the conductive layer disposed on the outer surface of the partition wall member is constituted to form a part of the hollow portion.

10 In a nineteenth aspect of the invention,  
there is provided the tube by electroforming  
according to the twelfth, thirteenth, fourteenth, fifteenth  
or eighteenth aspect of the invention,

wherein a portion of the partition wall member  
15 disposed between the hollow portions disposed adjacent to  
each other has a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or  
less.

In a twentieth aspect of the invention,  
there is provided a thin wire material for  
20 production of a tube by electroforming produced by forming  
an electrodeposit material or a surrounding material around  
the thin wire material by electroforming, and removing the  
thin wire material from the electrodeposit material or the  
surrounding material,

25 wherein an outer diameter of the thin wire  
material is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an outer  
shape of the thin wire material has a circular sectional

shape, a diameter of an inscribed circle is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the outer shape of the thin wire material has a polygonal sectional shape, and a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of a sectional area.

In a twenty-fifth aspect of the invention,

there is provided a thin wire material for production of a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, pulling the thin wire material from one end or both ends to deform the material so that a sectional area thereof is reduced, forming a clearance between the thin wire material and the electrodeposit material or the surrounding material to extract the thin wire material, and removing the thin wire material from the electrodeposit material or the surrounding material to produce a tube by electroforming,

wherein an outer diameter of the thin wire material is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an outer shape of the thin wire material has a circular sectional shape, a diameter of an inscribed circle is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the outer shape of the thin wire material has a polygonal sectional shape, and a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of the sectional area.

In a twenty-sixth aspect of the invention,  
there is provided the thin wire material for the  
production of the tube by electroforming according to the  
twentieth or twenty-fifth aspect of the invention,

5       having an outer surface provided with a conductive  
layer constituted of a material different from that of the  
electrodeposit material or the surrounding material.

In a twenty-seventh aspect of the invention,  
there is provided the thin wire material for the  
10       production of the tube by electroforming according to the  
twentieth or twenty-fifth aspect of the invention,

      having an outer surface provided with a conductive  
layer constituted of a material different from that of the  
electrodeposit material or the surrounding material, and a  
15       further conductive layer constituted of a material  
different from that of the conductive layer being disposed  
between a base member of the thin wire material and the  
conductive layer.

In a twenty-eighth aspect of the invention,  
20       there is provided the thin wire material for the  
production of the tube by electroforming according to the  
twentieth, twenty-fifth, twenty-sixth, twenty-seventh or  
twenty-eighth aspect of the invention,

      wherein there are opposite end portions on which  
25       any conductive layer is not disposed.

In a twenty-ninth aspect of the invention,  
there is provided the thin wire material for the



production of the tube by electroforming according to the twentieth, twenty-fifth, twenty-sixth, twenty-seventh or twenty-eighth aspect of the invention,

having an outer shape formed into a circular sectional shape or a polygonal sectional shape.

In a thirtieth aspect of the invention,

there is provided a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape.

In a thirty-first aspect of the invention,

there is provided a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, pulling the thin wire material from one end or both ends to deform the material so that a sectional area thereof is reduced, forming a clearance between the thin wire material and the electrodeposit material or the



surrounding material to extract the thin wire material, and removing the thin wire material from the electrodeposit material or the surrounding material,

5 wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion  
10 is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape.

In a thirty-second aspect of the invention,  
there is provided the tube by electroforming according to the thirtieth or thirty-first aspect of the  
15 invention, having a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

In a thirty-third aspect of the invention,  
there is provided the tube by electroforming according to the thirtieth, thirty-first or thirty-second  
20 aspect of the invention,

having an inner surface provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material.

In a thirty-fourth aspect of the invention,  
25 there is provided the tube by electroforming according to the thirtieth, thirty-first or thirty-second aspect of the invention,

having an inner surface of the tube provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material, a further conductive layer constituted of a material different from that of the conductive layer being disposed between the electrodeposit material or the surrounding material and the conductive layer.

In a thirty-fifth aspect of the invention, there is provided the tube by electroforming according to the thirtieth, thirty-second, thirty-third or thirty-fourth aspect of the invention,

wherein there are a plurality of hollow portions formed by removing the thin wire material.

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As to the thin wire material, there can be used a material such as a metal wire material entirely formed of a conductive material, or a material formed by disposing the conductive layer (e.g., a metal such as plating, carbon or the like) around the conductive material. Alternatively, there can be used a material formed by using a thin wire material formed of an insulating material, such as a synthetic resin wire material, and disposing a conductive layer (e.g., a metal such as electroless plating, carbon or the like) around this material.

20

Furthermore, in a case where a separate conductor is disposed in the vicinity of the thin wire material, and a metal is electrodeposited (deposited) on the conductor, in addition to the above thin wire material, there can further be used a material entirely formed of an insulating material (any conductive material is not disposed), such as the synthetic resin wire material.

25

CLAIMS

1. (deleted)

5 2. (deleted)

3. (corrected) A tube electroforming method  
comprising the steps of: forming an electrodeposit material  
or a surrounding material around a thin wire material by  
10 electroforming; and removing the thin wire material from  
the electrodeposit material or the surrounding material,  
wherein the thin wire material is removed by  
pulling the material from one end or both ends, deforming  
the material so as to reduce a sectional area thereof, and  
15 forming a clearance between the thin wire material and the  
electrodeposit material or the surrounding material,  
followed by gripping and pulling the thin wire material,  
sucking the material, physically pushing away the material,  
or blowing a gas or a liquid to push away the material.

20

4. (corrected) The tube electroforming method  
according to claim 3,

wherein an amount of an end-portion-side  
electrodeposit or surrounding material to be formed on the  
25 thin wire material is increased.

5. (corrected) The tube electroforming method

according to claim 3,

wherein a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of the sectional area.

5

6. (deleted)

7. (corrected) The tube electroforming method according to claim 3, 4 or 5,

10

wherein the thin wire material including a conductive layer disposed on an outer surface thereof is used, and the thin wire material is removed so that the conductive layer remains on an inner surface of a tube by electroforming.

15

8. (corrected) The tube electroforming method according to claim 3, 4 or 5,

20

wherein the thin wire material is used in which at least two conductive layers constituted of different materials are formed on an outer surface of the material, the electrodeposit material or the surrounding material is brought into close contact with the outer conductive layer of the thin wire material, and the thin wire material is removed so that the inner conductive layer remains on an inner surface of the tube by electroforming.

25

9. (corrected) The tube electroforming method

according to claim 3, 4, 5, 7 or 8,

wherein an inner shape of a hollow portion formed  
by removing the thin wire material from the electrodeposit  
material or the surrounding material has a circular  
5 sectional shape or a polygonal sectional shape.

10. (corrected) The tube electroforming method  
according to claim 3, 4, 5, 7, 8 or 9,

wherein the tube by electroforming includes a  
10 plurality of hollow portions formed by removing the thin  
wire material.

11. (corrected) The tube electroforming method  
according to claim 10,

15 wherein a partition wall member formed by  
disposing a conductive layer on an outer surface of an  
insulating material is disposed between the hollow  
portions, whereby each portion forming a periphery of each  
hollow portion independently conducts electricity.

20

12. (corrected) A tube by electroforming produced  
by forming an electrodeposit material or a surrounding  
material around a thin wire material by electroforming, and  
removing the thin wire material from the electrodeposit  
25 material or the surrounding material,

wherein a hollow portion is formed by removing the  
thin wire material from the electrodeposit material or the

surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, a diameter of an inscribed circle of the hollow portion is  
5 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape,

there are a plurality of hollow portions formed by removing the thin wire material, and

a partition wall member formed by disposing a  
10 conductive layer on an outer surface of an insulating material is disposed between the hollow portions, whereby each portion forming a periphery of each hollow portion independently conducts electricity.

15 13. (corrected) The tube by electroforming according to claim 12, having a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

20 14. (corrected) The tube by electroforming according to claim 12 or 13, having an inner surface provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material.

25 15. (corrected) The tube by electroforming according to claim 12 or 13, having an inner surface of the tube provided with a conductive layer constituted of a

material different from that of the electrodeposit material  
or the surrounding material, a further conductive layer  
constituted of a material different from that of the  
conductive layer being disposed between the electrodeposit  
5 material or the surrounding material and the conductive  
layer.

16. (deleted)

10 17. (deleted)

18. (corrected) The tube by electroforming  
according to claim 12, 13, 14 or 15, wherein the conductive  
layer disposed on the outer surface of the partition wall  
15 member is constituted to form a part of the hollow portion.

19. (corrected) The tube by electroforming  
according to claim 12, 13, 14, 15 or 18, wherein a portion  
of the partition wall member disposed between the hollow  
20 portions disposed adjacent to each other has a thickness of  
5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

20. (corrected) A thin wire material for  
production of a tube by electroforming produced by forming  
25 an electrodeposit material or a surrounding material around  
the thin wire material by electroforming, and removing the  
thin wire material from the electrodeposit material or the



surrounding material,

wherein an outer diameter of the thin wire material is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an outer shape of the thin wire material has a circular sectional shape, a diameter of an inscribed circle is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the outer shape of the thin wire material has a polygonal sectional shape, and a deformation amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of a sectional area.

21. (deleted)

22. (deleted)

23. (deleted)

24. (deleted)

25. (added) A thin wire material for production of a tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, pulling the thin wire material from one end or both ends to deform the material so that a sectional area thereof is reduced, forming a clearance between the thin wire material and the electrodeposit material or the surrounding material to

extract the thin wire material, and removing the thin wire material from the electrodeposit material or the surrounding material to produce a tube by electroforming,

wherein an outer diameter of the thin wire

5 material is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an outer shape of the thin wire material has a circular sectional shape, a diameter of an inscribed circle is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the outer shape of the thin wire material has a polygonal sectional shape, and a deformation  
10 amount of a lateral distortion at a time when the thin wire material is pulled and extended outwards is 5% or more of the sectional area.

26. (added) The thin wire material for the  
15 production of the tube by electroforming according to claim 20 or 25, having an outer surface provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material.

20

27. (added) The thin wire material for the  
production of the tube by electroforming according to claim  
20 or 25, having an outer surface of the material provided  
with a conductive layer constituted of a material different  
25 from that of the electrodeposit material or the surrounding material, a further conductive layer constituted of a material different from that of the conductive layer being

disposed between a base member of the thin wire material and the conductive layer.

28. (added) The thin wire material for the  
5 production of the tube by electroforming according to claim 20, 25, 26, 27 or 28, wherein there are opposite end portions on which any conductive layer is not disposed.

29. (added) The thin wire material for the  
10 production of the tube by electroforming according to claim 20, 25, 26, 27 or 28, having an outer shape formed into a circular sectional shape or a polygonal sectional shape.

30. (added) A tube by electroforming produced by  
15 forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein a hollow portion is formed by removing the  
20 thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion  
25 is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape.

31. (added) A tube by electroforming produced by forming an electrodeposit material or a surrounding material around the thin wire material by electroforming, pulling the thin wire material from one end or both ends to deform the material so that a sectional area thereof is reduced, forming a clearance between the thin wire material and the electrodeposit material or the surrounding material to extract the thin wire material, and removing the thin wire material from the electrodeposit material or the surrounding material,

wherein a hollow portion is formed by removing the thin wire material from the electrodeposit material or the surrounding material, an inner diameter of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when an inner shape of the hollow portion has a circular sectional shape, and a diameter of an inscribed circle of the hollow portion is 10  $\mu\text{m}$  or more and 85  $\mu\text{m}$  or less, when the inner shape of the hollow portion has a polygonal sectional shape.

32. (added) The tube by electroforming according to claim 30 or 31, having a thickness of 5  $\mu\text{m}$  or more and 50  $\mu\text{m}$  or less.

33. (added) The tube by electroforming according to claim 30, 31 or 32, having an inner surface provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding

material.

34. (added) The tube by electroforming according to claim 30, 31 or 32, having an inner surface provided with a conductive layer constituted of a material different from that of the electrodeposit material or the surrounding material, a further conductive layer constituted of a material different from that of the conductive layer being disposed between the electrodeposit material or the surrounding material and the conductive layer.

35. (added) The tube by electroforming according to claim 31, 32, 33 or 34, wherein there are a plurality of hollow portions formed by removing the thin wire material.

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